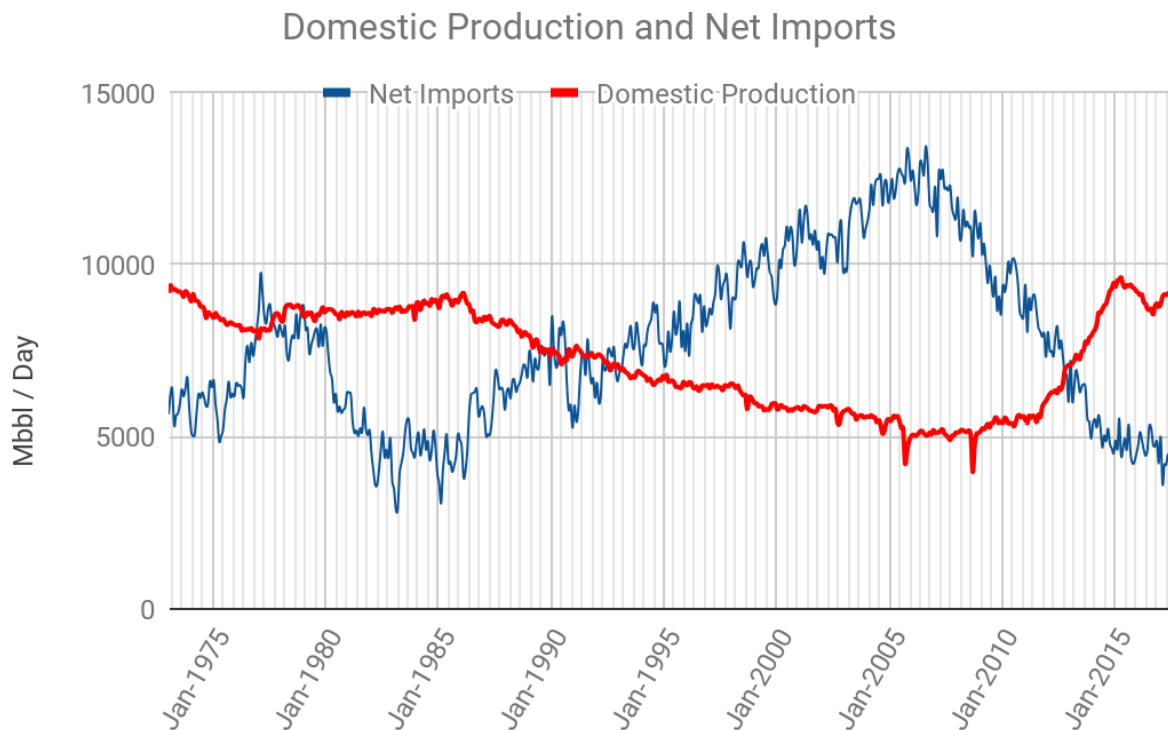


UNITED STATES SENATE
COMMITTEE ON COMMERCE, SCIENCE, AND TRANSPORTATION
“Advancing the Internet of Things in Rural America”
November 7th, 2017 - Armitage Testimony

During the fall of 2014, in response to precipitous declines in commodity prices, the oil and gas industry moved from *drill baby drill* to *tighten the belts, the ride’s gettin’ rough*.

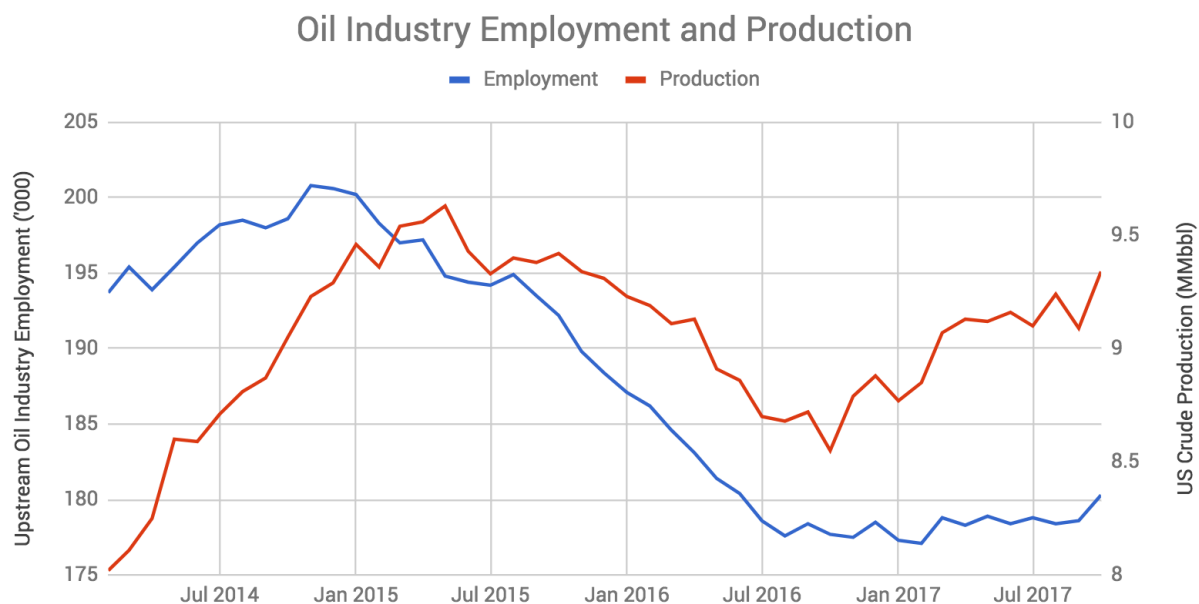
The domestic oil and gas industry is resilient and resourceful. In the past 20 years, horizontal drilling and hydraulic fracturing technologies opened up resources in the US that have us on a path to energy self-sufficiency. The US is on track to exceed the country’s all time high of 10 MMbbl/day reached in November of 1970. That reality would have seemed like a fantasy two decades ago. The implications for the US economy and geopolitics are profound.



Source: Energy Information Administration

Despite all the success the industry has realized in reducing the costs to find the next barrel of oil, we are still a relatively high cost producer. The Industrial Internet of Things is not hype or Silicon Valley's latest buzzword. IoT is helping to streamline business process, enhance safety, reduce environmental impact, and improve utilization of critical assets. Every aspect of energy production is being impacted by realtime remote monitoring, predictive analytics, Cloud computing, smart sensors, and machine learning. Advanced automation and remote monitoring systems are pushing connectivity into remote areas, to the benefit of rural communities. But there is no free lunch.

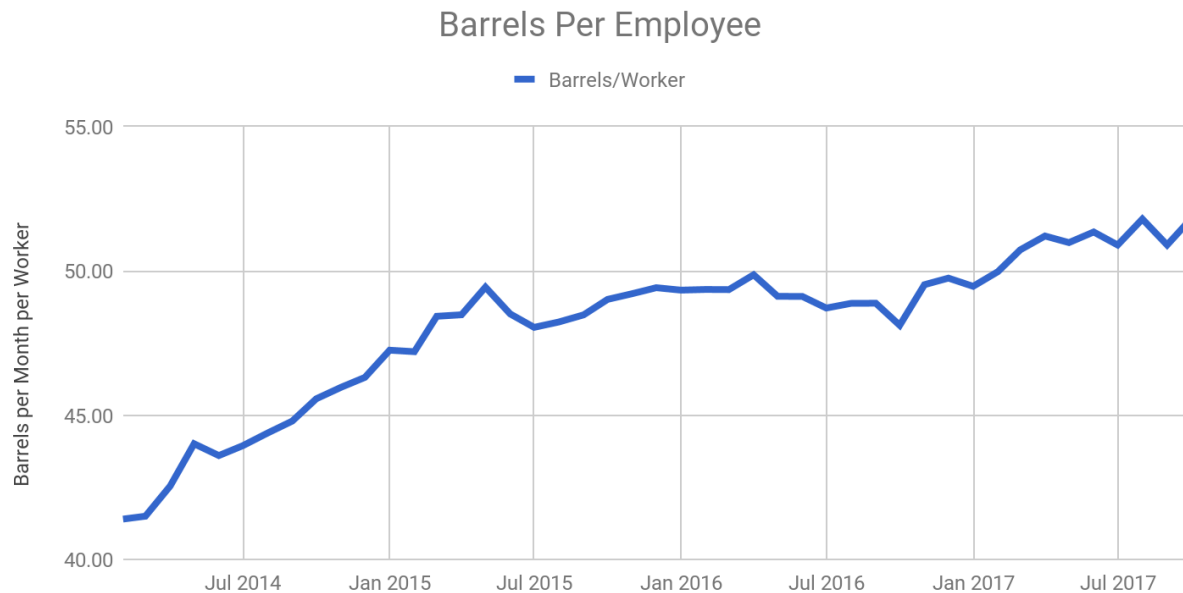
The margin squeeze of the past three years has been painful. Tens of thousands of workers have lost their jobs, the budgets of rural communities have been slashed, and many firms have been forced into bankruptcy. We have seen the upstream oil and gas industry workforce decline over 20%.



Source: Energy Information Administration and Bureau of Labor Statistics

The industry's rapid response to lower commodity prices provides an interesting petri dish to study the implications, both good and bad, of the Internet of Things on our society. In the past three years the number of barrels produced per worker has increased by over 27%. We can find no other examples in recent history where an industry of such scale has managed such a dramatic increase in worker productivity. There may be several factors contributing to this remark-

able increase, but there can be no question that the industry's embrace of Industrial IoT has played a significant role.



Source: Energy Information Administration and Bureau of Labor Statistics

Industrial IoT utilizes remote sensors to deliver data to the Cloud servers where algorithms sift through the telemetry to identify actionable insights that streamline business response. The connectivity implicit in this architecture is bringing wireless, high speed networks to remote areas of our country where population densities would otherwise not provide sufficient economic incentive for cellular and broadband carriers. At Cartasite, we utilize realtime vehicle monitoring technology to help oil field workers get home safely to their families every night. Large corporations like Anadarko Petroleum, Encana, and ConocoPhillips leverage this IoT data to optimize deployment of field workers, resulting in reductions in crashes, traffic, fuel consumption, and emissions. These industry fleets traverse some of the nation's most remote areas and provide us with some interesting insights. We see first hand the negative impact on productivity and safety that come from a lack of cellular coverage off of the highway and major road networks. These companies have worked closely with the cellular carriers to enhance coverage, in some cases even funding the deployment of new cell towers.

Remote worker safety is a critical issue for many industries, including oil and gas, utilities, forestry, agriculture, and rail. The lack of cellular coverage has led industry to seek out alternative systems, including private radio networks and satellite beacons. As coverage is enhanced we can anticipate more effective integration with state and federal emergency response infrastructure.

While wellsite and pipeline monitoring technology has been available for over thirty years, penetration remains surprisingly low in many areas. The cost and complexity of legacy systems has placed the technology beyond the reach of many operators. This is changing quickly. Smartphones have accelerated the commoditization of sensors, GPS processors, and cellular modems. Industrial IoT is riding this wave and bringing to market simple tags with exotic capabilities. At Cartasite, we have a system in our labs which is able to detect unintended methane leaks from remote wellsites and report on these 'fugitive' gas emissions over the cellular network. This data feeds into worldVIEW, a realtime geospatial dashboard that companies can use to dispatch inspection and repair crews. Methane is a significant greenhouse gas, some 80 times worse than CO2 for our planet. The industry has worked closely with the EPA to reduce these unintended fugitive emissions and our Project Canary is an outstanding example of an Industrial IoT technology which will help lessen the environmental impact of oil field operations.

The Digital Oilfield is ushering a new era of highly efficient, safer, and more cost-effective field operations. The industry is rapidly moving from 'management by schedule' to 'management by exception' driven by the realtime insights garnered from remote monitoring technologies. The oil and gas industry is embracing these technologies to ensure the safety of their workers, the security of critical assets, and the economic viability of the industry.

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